EXHIBIT 2

Exhibit 2 - Topics Related to Dr. Hal Singer's Opinions

The following are the positions of Dr. Singer and Dr. Leonard on the agreed upon issues of disagreement for the concurrent expert witness proceeding to be held on August 1, 2023:

1. **Dr. Singer's Consumer Subsidy Models**

Dr. Singer's position

Dr. Singer uses two separate methods to calculate direct consumer overcharges. One method Dr. Singer used is based on Amazon's direct discounts to consumers. The other calculates overcharges using a standard economic model (Rochet-Tirole). Both of these methods calculate the amount of overcharge that Google's anticompetitive conduct caused consumers in the form of foregone direct discounts. Absent Google's anticompetitive conduct, the Play Store would have been forced to compete by providing consumers direct discounts that would lower the prices that a consumer would have paid for apps and in-app content.

a. The Amazon Discount Model

The direct consumer discounts that Amazon provided to compete with other app stores on Android devices provide a reliable estimate of injury and damages. The Amazon Appstore competes in the same app distribution market as the Play Store and is comparable to the Play Store except that the Amazon Appstore lacks market power. The Amazon Appstore's discounts reliably quantify consumer overcharges because, had Google faced robust competition in app distribution from a well-established tech platform such as Amazon, it would have been obliged to match or nearly match those discounts to keep consumers in the Play Store. Instead, Google suppressed competition through the challenged conduct, allowing it to avoid price competition. Amazon's data shows that consumers received, in the aggregate, substantial discounts on Google Android devices in the form of Amazon Coins, which allow consumers to purchase apps and in-app products at lower prices in the Amazon Appstore.[1] Amazon Coins account for a significant majority of consumer expenditure in the Amazon Appstore. This provides evidence that, when direct discounts reach competitive levels (unlike Google's current paltry discounts), consumers will take advantage of them.

Google's argument that Amazon is not an appropriate benchmark due to the Amazon Appstore's low market share is meritless. If Google were obliged to compete on the merits, Google would reasonably be expected to match or nearly match the discounts provided by a viable competitor with Amazon's stature. Google's argument that Dr. Singer should have focused on Fire OS devices instead of Android devices does not make economic sense. In the

[1] The precise usage and discount data remain under seal. *See* ECF 510.2 ¶¶ 417-20 for details.

actual world, Amazon has been obliged to compete with Google on Android devices supplied by third parties (as opposed to Fire OS devices, which Amazon makes). In the but-for world, Google would have been obliged to compete on the merits on the same third-party devices. That Amazon Coins (which users purchase and then use as currency) do not operate in exactly the same way as Google's Play Points (which are comparable to frequent flyer miles) is of no matter because the economic analysis is agnostic as to the exact form of the discount program. What matters for the economic analysis is the size of the discount that Google would be obliged to match (or nearly match) to keep consumers in the Play Store in a competitive market. Likewise, that Amazon did not permit Coins to be used on subscriptions does not undermine Amazon as an appropriate benchmark. Indeed, by including **all** consumer expenditure on apps, in-app purchases, and subscriptions in the denominator of his analysis, while no subscriptions were discounted in the numerator, Dr. Singer provided a conservative estimate of the average discount. The size of Amazon's discounts when measured against *all sales* informs the amount that a firm attempting to compete on price would remit to back to consumers.

b. The Rochet-Tirole Direct Discount Model

In addition to the Amazon benchmark, Dr. Singer uses an economic model to calculate the size of the direct consumer discounts that Google would have provided in a competitive market. For this analysis, Dr. Singer uses a model of competition in two-sided markets developed by Jean-Charles Rochet and Nobel Prize winner Jean Tirole. This analysis provides a more conservative estimate of direct consumer discount damages, because it assumes that Google would have enjoyed an "incumbency advantage," in the form of a 60% market share in the but-for world. Google's incumbency advantage would allow it to retain this market share while offering less-generous consumer discounts than those calculated using the Amazon Appstore benchmark. To the extent that the jury agrees with Google that it would enjoy significant brand loyalty even in a more competitive but-for world, this model provides an alternative.

Dr. Singer will address Google's critique of the 60% market share input, which is based on peer-reviewed literature regarding the effect of competition and price elasticity as AT&T's market share declined with competition. It is also corroborated by evidence from a range of other markets. Dr. Singer will explain that: (1) an input based on AT&T's experience as a former network monopolist is reliable; (2) AT&T is a conservative benchmark because post-monopolistic market shares in other tech markets are *lower*, meaning they result in *higher* damages; and (3) in any event, the model is not "extremely sensitive" to changes in the "but for market share" as Dr. Leonard claims. Dr. Leonard's own analysis shows that, if the but-for market share is increased from 60% to 70%, the but-for take rate in the In-App Aftermarket increases by only one percentage point. Moreover, Dr. Leonard's purported sensitivity analysis involves arbitrarily changing *two* inputs at once or plugging ever-higher but-for market shares

into Dr. Singer's models without any economic basis—disregarding the fact that 60% is already conservatively high.

Dr. Singer will also address Google's claim that the model fails to show that increased discounts would benefit all or nearly all consumers. In a more competitive world, Google would have clear economic incentives to automatically provide discounts to users, or at least to minimize enrollment costs, allowing Google to compete on price, rather than engaging in exclusion.

Dr. Leonard's position

Dr. Singer's two consumer subsidy models to estimate damages – his "Discount Model" based on Google's existing Play Points program and his "Amazon Discount Model" based on Amazon Coins – are unreliable to show injury and damages because they assume rather than try to prove that consumers were injured. Specifically, both models imply that *all* consumers would have signed up to receive consumer subsidies, such as Google Play Points, in the but-for world. Dr. Singer has not done any economic analysis to support this implicit assumption of his consumer subsidy models. In the actual world, only a fraction of users signed up for Play Points. There are a number of reasons why a user might not want to sign up for a rewards program in the but-for world, including that the subsidy was not sufficiently high, the user wanted to avoid receiving communications, or the user had privacy concerns. Dr. Singer did not analyze what level of rewards would be necessary to get any given consumer to sign up for Play Points, let alone all consumers. Nor did he analyze the relationship between the value of Play Points and demand for the program or the elasticity of demand for that program. Dr. Singer simply assumes that *all* users would have signed up in the but-for world, despite many not doing so in the actual world. Dr. Singer has no basis for this assumption, which means that he cannot reliably calculate injury and damages using models based on Play Points. Dr. Singer has no evidence that Google would automatically enroll all users in the Play Points program and offer subsidies on all purchases in the Google Play store.

In addition, the benchmarks that Dr. Singer uses for his subsidy models are unsupported. For the Play Points Discount Model, Dr. Singer's use of AT&T long distance wireline telephone service for consumers in the 1980s as a "benchmark" for Google Play's services for smartphone app developers in the current day is entirely invalid as a matter of economics. Dr. Singer has done nothing to demonstrate that the long-distance wireline telephone service market in the 1980s is economically similar to any market related to Android app distribution and IAP services that would have existed absent Google's challenged conduct. Contrary to Plaintiffs' claim, the model is extremely sensitive to changes in the but-for market share, as Dr. Leonard demonstrated in his report.

Dr. Singer's Amazon Coins benchmark also is economically unreliable. His Amazon Discount Model begins from the premise that Amazon paid subsidies on purchases of apps and IAPs in the Amazon Appstore on Android devices that, in the aggregate, totaled more than a certain percentage of the Amazon Appstore's revenue. That percentage figure is not the Amazon Coins discount that Amazon offered on *each* app, IAP or subscription. In fact, Amazon did not offer *any* Coins discounts on *any* subscriptions and Coins discounts, like Play Points, were only available to the small fraction of users who chose to participate in the Coins program. Rather, the percentage figure is the *total* amount of Amazon Coins discounts on *all* purchases divided by Amazon's *total* revenue on *all* purchases from the Amazon Appstore. Dr. Singer, however, assumes that in the but-for world, Google would have provided discounts that could be used on *every* app, IAP and subscription in the entire Google Play store for *every* user by percentage figure he calculated even though that is not what his own benchmark—the Amazon Appstore—did. Dr. Singer has no basis for this assumption and cannot explain why Google would have offered discounts that Amazon did not offer.

Dr. Singer does not account for other critical differences between Amazon Coins and Play Points, such as the need to prepay for Amazon Coins before using them and inability to use Coins with other forms of payment that require Amazon to offer a larger discount to induce users to buy Coins. This matters because the structure of the program and limitations on how Amazon Coins can be used affect the economic analysis of whether Amazon's discounts are a proper benchmark. Because Amazon Coins have significant limitations, Amazon must offer significant discounts for using the Coins in order to persuade consumers to buy the Coins. Google does not have to do this in the Play store because Play Points do not have the same limitations. Thus, Amazon's discounts are more significant than one would expect Google to provide for the Play store.

2. Developers' Prices After Service Fee Reductions

Dr. Singer's position

Google's recent limited take rate adjustments do not provide anything close to a "natural experiment" for measuring pass-through. Dr. Singer will explain that the transaction data at issue did not include economically meaningful and sustained take rate changes, and therefore, under standard economic principles, a direct analysis for pass through would be unreliable. Google's own transaction data show that Google's take rate reductions in the actual world have been short-lived, limited in scope, and unpredictable. Performing a reliable direct measurement of the pass-through rate using these take-rate reductions is not possible, particularly when the broad trends regarding Google's take rate reductions indicate that many of those the reductions were largely transitory, the supracompetitive take rate has been in place since well before the start of the Class Period, and Google's monopoly power and conduct persists.

In contrast, in a more competitive but-for world, take rates would have been substantially and permanently lower across the board, resulting in substantially lower marginal costs for developers. That lower marginal costs ultimately result in lower consumer prices is an uncontroversial textbook economic principle, one that Dr. Leonard has emphasized in print. Yet Dr. Leonard's results contradict this fundamental economic principle. Although his estimates are all over the place, most of them—including his "best" estimates of pass-through—are negative, implying nonsensically that developers *raised* their prices in response to *lower* costs. Dr. Leonard's nonsensical and unreliable results flow from his flawed analysis.

Dr. Leonard's pass-through analysis is unreliable and does not undermine the economic modeling that Dr. Singer performed for numerous reasons. Dr. Singer will explain why reliable conclusions cannot be drawn from Dr. Leonard's flawed analysis and limited data.

As an initial matter, as Dr. Leonard has correctly observed, firms rarely adjust prices instantaneously in the real world, due to factors such as sticky prices. In the but-for world, marginal costs would have been permanently and substantially lower for the duration of (and before) the class period, providing more than enough time for lower costs to be reflected in consumer prices during the class period.

Second, Dr. Leonard used a very limited amount of data. Dr. Singer used *all* of the transaction data available to test the logit model, while Dr. Leonard only examined a limited amount of data over a limited period of time. Dr. Leonard's treatment group represented approximately one percent of aggregate purchases by consumers over the relatively short time period he studied. The data that Dr. Leonard examined does not support Dr. Leonard's sweeping conclusion that, if all or almost all developers had enjoyed substantially lower costs throughout the class period (or longer), app prices would have been no more than 3% lower.

Third, Dr. Leonard ignores that adjustments in Google's take rate were short-lived, limited, and unpredictable. Therefore, it would not be economically reasonable to expect developers to adjust their prices based on potentially transitory reductions in costs. Since the full effect of any lower take rate would take time to be reflected in a developers' financials, limited and unpredictable take rate reductions would not be reflected in developers' prices, especially over the short time horizons to which Dr. Leonard limits his analysis and given Dr. Leonard's misguided focus on individual SKUs.

Fourth, Dr. Leonard lacked adequate controls and failed to adequately adjust for the effects of inflation. Dr. Leonard's "control group" was not a control group at all. The pool of developers in that group were drastically different than the developers in the treatment group. And his use of these groups to "control" for inflation was also flawed. In his "synthetic control regressions" Dr. Leonard "controlled" for inflation only by assuming baselessly that two vastly

different sets of developers were comparable. For example, the average annual per-developer consumer expenditure in Dr. Leonard's "control group" was $3.4 million in 2021, compared to just $44,000 in Dr. Leonard's "treatment group."

In short, the failure of Dr. Leonard's experiment was inevitable—as Dr. Singer previously explained, there was not enough variation in the data to conduct a reliable regression analysis. Class Cert Hot Tub Tr. 62:21-63:9. Dr. Leonard's attempt to do so in spite of those limitations reveals the folly of that approach.

Google's claim that the pass-through rates predicted by a standard economic model are inapplicable unless prices "always" change "immediately" in response to lower costs is flatly incorrect and misrepresents how economic models are applied to real-world data. As standard economics directs, and as Dr. Leonard has stated in his academic writings, when a direct analysis is unreliable, an indirect analysis is appropriate, estimating pass-through based on the shape of the demand curve. Accordingly, as discussed in the following topics, Dr. Singer conducted a rigorous econometric analysis of all the transaction data and found that the logit demand model was an appropriate model to determine a reasonable estimate for pass through.

Separately, in the course of defending Dr. Leonard's use of transactional data, Google now shoehorns in a new, never before raised, attack on Dr. Singer's model. That attack is based on a misrepresentation of his deposition testimony along with a misrepresentation of Dr Singer's calculation of individual damages. Google falsely claims that the logit model predicts that the prices of apps increase when take rates decrease. Not so.

Google's claim of "absurd" results for individual damages using the logit model only occurs when the model is improperly applied. In his individual damages report, Dr. Singer reasonably calculated damages using category-specific overcharges; the overcharge for each category was calculated using the actual and but-for take rate for that category. And as Dr. Singer will explain in detail, his pass-through analysis is predicated on a rigorous empirical analysis, based on the full range of Google's transactional data. As Dr. Singer explains in his supplemental merits reply report, damages can also be calculated at the individual transaction level; under this approach, the overcharge for a given transaction is calculated using the actual and but-for take rate for that transaction. For each transaction, take rate declines proportionally in the but-for world. When the but-for take rates for individual transactions are calculated appropriately and consistently, at no time would an overcharge be greater than the service fee actually paid by a developer on that transaction.

Google is incorrect to claim that Dr. Singer's transaction-level analysis in his supplemental reply predicts that "prices for the same product would increase when the developer's service fee would decrease." Google misrepresents Dr. Singer's deposition

testimony to suggest that his model shows that when take rates decrease, app prices increase. His model *does not* show that, as he explained in his deposition. Singer Tr. 29:33-30:1 ("My model will always predict when all things are equal, a lower service fee will generate a lower price for sure. There's no way to get around that."). In the example Google references, other things are *not* held equal. Google picked two different transactions. In one of them, the developer has significantly more cost savings available to pass through to the consumer than it does in the other. This means that the two transactions are not directly comparable, as Google assumes.

Dr. Leonard's position

No economic literature supports Dr. Singer's use of the logit model to derive his "1 minus category share" formula for the pass-through rate, which fails to meet general standards of economics. Although Dr. Singer's formula predicts prices will always change immediately when the service fee changes, the formula fails to accurately predict real-world prices after Google reduced its service fee. The proper way to test an economic model like Dr. Singer's is to measure whether it predicts real-world behavior. Dr. Singer's model flunks this test because it does not predict how developers set prices in the real world. Dr. Singer's formula is based on the principle that "prices fall as marginal costs decline" (MDL Dkt No. 487-2, Ex. 1, Singer Merits Report ¶ 337). If that were correct, then one can test Dr. Singer's formula by analyzing whether developers lowered their prices in the real world when the costs of the service fees they paid to Google went down. Dr. Singer has not even tried to use data to test whether developers reduced prices when Google reduced their service fees. Plaintiffs' suggestion to the contrary is completely misleading. The "econometric" analysis Plaintiffs are referring to was not a test of whether Dr. Singer's model accurately predicts ***if*** developers would change their prices if ***service fees*** changed. Dr. Singer instead tested whether a developer's ***share of its category*** changed when developers ***did*** change their prices. Thus, Dr. Singer's use of data takes as given what his pass-through model supposedly proves, which cannot show that the model is reliable. D An economist who refuses to test his model using actual data is not using reliable economic methods.

In fact, the only estimates of prices in the but-for world Dr. Singer has conducted involve absurd results and predictions that he admits violate basic economic principles. For example, when he first calculated damages for individual plaintiffs, Dr. Singer employed a methodology that calculated overcharges greater than the service fee paid by the developer. When Dr. Singer tried to correct this problem in a supplemental reply report, he predicted that ***prices for the same product would be higher when the transaction was subject to a lower service fee rate–for example, that a developer would charge a higher price at a 7% service fee rate than at a 14% service fee rate.*** But Dr. Singer testified that developers charging higher prices at lower service fees ***"would not be consistent" with the logit model.*** Singer Dep. Tr. (Jul. 18, 2023) at 15:21-25. The claim that Dr. Singer's predictions have been misrepresented is false. Dr. Singer's own materials calculate higher prices for the same products at lower service fee rates in the but-for world.

Dr. Leonard did test whether, in the real world, prices fell when Google reduced service fees. Dr. Leonard analyzed Google's real-world data and found that developers overwhelmingly did not reduce app prices when Google lowered its service fees from 30% to 15% for ***all*** subscriptions and for apps earning less than $1 million annually. In other words, what Dr. Singer's formula predicts did not, in fact, happen. Dr. Singer has not offered any reason with any grounding in economics that explains why his formula makes enormous errors in predicting developers' real-world behavior:

- Dr. Leonard examined sufficient data: more than 900,000 observations. Dr. Singer did not even try to show that analyzing a broader data set would show more pass-through than Dr. Leonard found, so any suggestion that more data would have changed the result is complete speculation. The assertion that Dr. Singer "used *all* of the transaction data available to test the logit model" is completely misleading. Dr. Singer failed to test *any* Google transactional data to determine whether developers reduced prices when Google reduced service fees. That is not what Dr. Singer's logit regressions were analyzing or testing. Those regressions measure the relationship between prices and category shares, not the relationship between service fees and prices.

- Dr. Singer's reliance on "price stickiness" to explain why prices did not fall in the real world is incoherent. Dr. Singer has built a model based on the principle that "prices fall as marginal costs decline" and claims that his model based on this principle "fits the data." But Dr. Singer also claims that his predictions do not explain the data because prices are sticky: they do *not* change even when marginal costs decline. Dr. Singer must contradict himself about whether prices should change when service fees change because his model contravenes economics.

- The assertion that Dr. Leonard did not account for inflation is simply wrong. Dr. Leonard's analysis did account for inflation. If inflation explained developers' pricing, then one would expect developers whose service fees did not go down to have raised their prices to keep up with inflation. That did not happen.

3. Analysis of Pass Through Based on Economic Modeling

a. Focal Point Pricing

Dr. Singer's position

Google has not demonstrated that focal point pricing in .99 cent increments would have kept prices at inflated levels in a more competitive but-for world. Based on the evidence, Dr. Singer has reliably concluded that focal point pricing at .99 cent intervals would not get in the way of a price reduction. Even in the absence of a prolonged take rate decrease, developers have

already revealed their willingness to prominently display prices to consumers that do not end in ".99". For example, more than 20 percent of the top paid apps in the Play Store already have initial download prices that do not end in ".99". Google also required developers, until recently, to charge at least 99 cents. Developers requested (and ultimately received) increased pricing flexibility, eventually persuading Google to abandon its $0.99 pricing floor. Similarly, Apple recently announced new price points in the App Store. In addition to allowing ten-cent intervals, Apple also lowered its minimum price from $0.99 to $0.29. Such episodes demonstrate that focal-point pricing in nearly $1 increments is far from economically inevitable.

In any case, Dr. Singer will explain that his methodology can account for focal point pricing, including on an individual consumer level. When he allows for the possibility that developers would restrict themselves to prices ending in "9", consistent with how the economic literature defines focal-point pricing, Dr. Singer finds that only a *de minimis* share of expenditure (0.006%) and transactions (0.192%) would not have benefitted from lower prices due to focal-point pricing in the but-for world.

Dr. Leonard's position

Focal point pricing is an accepted economic phenomenon and there is no dispute that it is extremely common among app developers. A reliable pricing formula must account for such pricing behavior. Dr. Singer's pass-through model does not do so and therefore is unreliable. In the actual world, almost all transactions in the Google Play store were at prices ending in "99" cents. Dr. Singer's model fails to account for this focal pricing at all. For example, for a Netflix subscription SKU priced at $9.99, Dr. Singer's "App/In-App" damages model predicts a but-for price of $8.82. For the game Reigns purchased by individual plaintiff Mary Carr for $0.99, Dr. Singer's "App/In-App" damages model predicts a but-for price of $0.91 and his "Hybrid" damages model predicts a but-for price of $0.98. Dr. Singer has not conducted any analysis regarding why developers would abandon the focal point pricing strategy of setting prices ending in "99" that they adopted in the actual world. The fact that Google had a minimum price requirement of 99 cents does not explain why developers set prices ending in "99" cents because almost all developers with prices above 99 cents (which is the vast majority of developers) also set their prices ending in "99" cents. Dr. Singer's suggestion that developers could set prices ending in "9" is irrelevant because almost all developers set prices ending in "99" cents, not some other number ending in "9."

b. Developer's Marginal Costs

Dr. Singer's position

Dr. Singer will explain how his analysis accounts for marginal costs. Dr. Singer used standard economic methods to calculate the extent to which developers' marginal costs were inflated by Google's supracompetitive take rates throughout the class period, and the extent to which overcharges that resulted from these inflated costs were passed on to consumers.

Dr. Singer will also explain that his pass-through calculations account for developers' other marginal costs beyond the take rate. The initial equations from which the standard logit pass-through formula is derived (in published, peer-reviewed work) include marginal cost. This marginal cost term drops out of the pass-through formula, resulting in a pass-through rate that does not depend on the level of the developers' other marginal costs. Instead, the pass-through formula turns only on the change in marginal cost that results from the change in Google's take rate. This result is not specific to logit but holds for standard demand curves generally.

Google's claim that pass-through of marginal cost savings from a lower service fee would be proportional to a developer's *other* marginal costs is based on Dr. Leonard's own calculations that he performed solely for this case. While claiming it is a "fundamental and indisputable" economic principle, neither Google nor Dr. Leonard identified a single publication identifying this additional marginal cost term that Google claims is "essential." The pass-through formula that Dr. Singer uses, by contrast, is a mathematically correct formula, rigorously derived in a published, peer-reviewed publication. Dr. Singer did not invent this standard pass-through formula; he simply applied it to this case, after conducting a rigorous analysis of all the transaction data produced by Google in this case and determining that such data supports the use of the logit model.

Dr. Leonard's position

Dr. Singer's formula makes a math error that excludes a term that economists agree is essential to predict how a change in service fees would affect developer's prices. There is an economic consensus that the extent to which a developer would change its prices when a service fee is a percentage of a developer's price (i.e., an ad valorem fee) will be proportional to the developer's marginal costs other than the service fee. This is not "based on Dr. Leonard's own calculations that he performed solely for this case." It is a fundamental and indisputable economic principle. Thus, mathematical equations in Dr. Singer's own report illustrate this basic economic point. All else equal, a developer with higher marginal costs will reduce prices more than a developer with lower marginal costs subject to the same service fee reduction. Thus, even assuming that a developer's marginal costs are always positive, in order to reliably predict how

much a developer would have reduced prices, Dr. Singer's formula must account for the developer's marginal costs other than the service fee. However, Dr. Singer makes a math error that excludes the developer's other marginal costs from his pass-through formula. The error results from Dr. Singer's decision to begin with a formula that measures the change in price following a change in a per-unit cost at a fixed dollar amount rather than a change in a fee calculated as a percentage of the price charged. This fundamental economic error makes Dr. Singer's entire formula unreliable.

c. Application of the Logit Model to App Categories

Dr. Singer's position

The logit demand model is commonly used in applied antitrust economics to quantify the impact of increased costs on ultimate consumer prices. It is used to estimate pass-through in a variety of contexts, including mergers and cartels. Dr. Leonard's claim that logit has supposedly "fallen out of favor with economists" is misleading and incorrect. Dr. Leonard based his claim on articles published in the 1980s and 1990s; Dr. Singer has cited more recent publications clearly contradicting Dr. Leonard's claim, including a 2018 article authored by academics and DOJ economists explaining that logit is one of the primary models included in the antitrust software package developed by DOJ economists. Dr. Singer has also explained that the models that Dr. Leonard characterizes as addressing "the limitations of logit-like models" suffer from well-known problems, which can severely limit their applicability and accuracy when applied to real-world data sets such as the data used in this case. *See* Singer Merits Report ¶ 348, n.810, ECF 508.2.

Dr. Singer applied standard econometric methods (regression analysis) to Google's voluminous transactional data to confirm the logit applies in this case.

Dr. Singer will explain why and how he used Google's app categories in that analysis, which meaningfully organize substitution between apps within a category. Dr. Singer used the app categories in applying the logit demand model he uses to calculate pass-through. The Play Store's app categories consist of economically reasonable groupings of consumer tastes for different types of Apps, as recognized by a range of industry participants, including consumers, developers, and Google itself. Dr. Singer applied standard econometric methods (regression analysis) to Google's voluminous transactional data to determine that the logit model accurately predicts apps' shares within their respective Play Store categories: Dr. Singer's regressions show that the logit model explains over 95 percent of the variation of apps' share within Play Store categories. And for each of the Play Store's categories, the logit model accurately predicts the expected (negative and statistically significant) relationship between price and demand—that is, a downward-sloping demand curve. Google is wrong that the regressions merely show that when developers reduce their prices, their sales increase. Instead, they show that the increase in sales

fits a particularly shaped demand curve, according to equations from the standard logit model. Studying all the transaction data, Dr. Singer found that developers' prices inversely affect developers' share in a category in the manner predicted by the standard logit equations.

Dr. Singer tested other models, such as the linear demand model. The data did not consistently exhibit the relationship between price and demand that the linear model predicts, so the linear model was rejected.

Dr. Singer will explain that the logit model does not assume that all customers view all apps in a given category as perfectly interchangeable, but instead explicitly models differentiation within each Play Store category.

Dr. Singer will address Google's claim that he misapplied logit because the property of "IIA" or "proportional substitution"—when prices for one product increase, consumers switch to substitutes in proportion to their relative shares—is allegedly not satisfied. Dr. Singer will explain that it is reasonable to conclude that the proportional substitution property is satisfied here, as evidenced by his regressions described above, which demonstrate that, when an app's price increases, its share within its category falls in the manner predicted by the standard logit equations used in the economic literature. Moreover, logit is routinely and reliably used as an approximation even when IIA is not strictly satisfied, including regularly in the merger context. In other words, even if proportional substitution does not hold for *every* app or *every* product, the logit model would still be a reliable approximation of pass through. This is one reason that logit is still used so frequently by applied economists in a variety of contexts, including those with differentiated products (such as in price fixing cases).

Google argues for the first time here that Dr. Singer should have implemented "accepted tests of the IIA assumption." Nowhere in Dr. Leonard's expert disclosure does he opine on these tests, let alone attempt to apply them to this case. In fact, it is well-established that these tests can lead to unreliable results when applied to data such as that used in this case. Accordingly, logit is commonly applied without implementing these tests.

Dr. Leonard's position

A condition that economists agree is essential for the logit model that Dr. Singer used is missing. Dr. Singer claims that his regressions show that this error does not matter, but the regressions are not designed to test the condition that his model fails to satisfy and no economic literature supports measuring the model's reliability using those regressions.

Dr. Singer's pass-through formula for estimating consumer injury and damages is based on a logit model of demand for Android apps, subscriptions, and in-app purchases. One feature

of the logit model Dr. Singer used is the "irrelevance of independent alternatives" property, or IIA, which holds that all goods in the market where demand is being studied are substitutes for one another in proportion to their share of that market. There is an economic consensus that if real world demands do not satisfy this property, then the model will yield unreliable results. This is one reason why the logit model has fallen out of favor with economists, who have developed an entire branch of the field to address the limitations of logit-like models. As applied to demand for Android apps, the IIA principle means that all apps in a given app category must be substitutes for each other, and must be substitutes in proportion to their share of that category. However, Dr. Singer concedes that apps in each category fail this condition. This makes his entire model unreliable.

Dr. Singer's regressions do not show the contrary. None of Dr. Singer's regressions tests or could test whether apps in each category are substitutes in proportion to their share, so none of those regressions shows that using a logit model based on app categories is reliable. No economic literature supports the use of the regressions Dr. Singer ran to measure whether a logit model is reliable. Indeed, Dr. Singer failed to run the generally accepted econometric tests of the IIA assumption. Dr. Singer's regressions merely show that when developers reduce their prices, they tend to increase their sales, which is true for many demand models and does not show that the logit model is appropriate. And the phrase "economically reasonable groupings of consumer tastes" is not drawn from the economic literature and is not a term that economists use when applying logit models.